

U.S. Pat. App. Ser. No. 09/786,495
Amendment dated January 21, 2004
Reply to Office Action of July 22, 2003

PATENT

Attorney Docket 606-25-PCT-PA

Amendments to the Claims:

The following listing of the claims replaces all previous listings and versions of the claims in this application:

Listing of the Claims:

Claims 1-10 (canceled)

11. (new) Apparatus for automatic isolation of particles, comprising:

- a reservoir containing a solution with particles;
- a first container into which an amount of said solution with said particles is fed from said reservoir;
- a second container for accumulation of specific ones of said particles;
- a capillary tube device for picking out one of said specific particles from said first container and for transporting said specific particles to said second container;
- a computer system;
- a camera system for recording images of said particles and transferring those images digitally to said computer system; and
- a computer program implemented in said computer system, which computer program evaluates said images, identifies and selects said specific particle from said images by predetermined parameters, protocols physical/chemical and/or biochemical characteristics of said specific particle, and controls said picking out and said transport of said specific particle;
- said first container including a first tube with a transparent section, said first tube being connected to and communicating with said reservoir;
- said second container including a side-tube;
- said first tube having an internal flow of said solution with particles from said reservoir;
- said camera system recording images of said particles in said transparent section;

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said capillary tube device comprising a micro pump, which micro pump is connected to said first tube, and which micro pump by signal from said computer system picks out said specific particle from said solution by pumping a small portion of said solution containing said specific particle into said side-tube.

12. (new) Apparatus for automatic isolation of particles, comprising:

- a reservoir containing a solution with particles;
- a first container into which an amount of said solution with said particles is fed from said reservoir;
- a second container for accumulation of specific particles of said particles;
- a capillary tube device for picking out one of said specific particles from said first container and for transporting said specific particles to said second container, wherein said capillary tube device comprises a transparent section with an inner cross section larger than said specific particles;
- a computer system;
- a camera system for recording images of said particles and transferring those images digitally to said computer system, where the field of view of the camera contains said transparent section;
- and
- a computer program implemented in said computer system, which computer program evaluates said images, identifies and selects said specific particle from said images by predetermined parameters, protocols physical/chemical and/or biochemical characteristics of said specific particle, and controls said picking out and said transport of said specific particle.

13. (new) Apparatus for automatic isolation of particles, comprising:

- a reservoir containing a solution with particles;
- a first container into which an amount of said solution with said particles is fed from said reservoir;

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a second container for accumulation of specific ones of said particles;
a capillary tube device for picking out one of said specific particles from said first container and for transporting said specific particles to said second container, wherein said capillary tube device comprises a transparent section with an inner cross section larger than said specific particles;
a computer system;
a camera system for recording images of said particles and transferring those images digitally to said computer system, where the field of view of the camera contains said transparent section;
and
a computer program implemented in said computer system, which computer program evaluates said images, identifies and selects said specific particle from said images by predetermined parameters, protocols physical/chemical and/or biochemical characteristics of said specific particle, and controls said picking out and said transport of said specific particle;
said capillary tube device comprising:
a pipette with a transparent capillary end section for picking out said specific particle from said first container, said pipette comprising a piston inside said pipette that is moved by a moving device, which moving device is controlled by said computer system with said computer program, wherein the volume of the pipette chamber is changed by the movement of said piston;
and
a transport stage with motors for moving said pipette to the position of said specific particle and, after picking up said specific particle, transporting said specific particle to said second container, which transport stage is controlled by said computer with said computer program.

14. (new) Apparatus for automatic isolation of particles, comprising:

a reservoir containing a solution with particles;
a first container into which an amount of said solution with said particles is fed from said reservoir;

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a second container for accumulation of specific ones of said particles;
a capillary tube device for picking out one of said specific particles from said first container and for transporting said specific particles to said second container, wherein said capillary tube device comprises a transparent section with an inner cross section larger than said specific particles;
a computer system; and
a camera system for recording images of said particles and transferring those images digitally to said computer system, where the field of view of the camera contains said transparent section;
a computer program implemented in said computer system, which computer program evaluates said images, identifies and selects said specific particle from said images by predetermined parameters, protocols physical/chemical and/or biochemical characteristics of said specific particle, and controls said picking out and said transport of said specific particle;
said capillary tube device comprising:
a pipette with a transparent capillary end section for picking out said specific particle from said first container by sucking out of said first container a small portion of solution that contains said particle;
a transport tube connected to said pipette for transporting said specific particle from said capillary end section to said second container;
a piston inside said pipette, wherein the volume of the pipette chamber is changed by the movement of said piston;
a moving device to move said piston between a first and a second position, which moving device is controlled by said computer system with said computer program determining the first and second position, where said piston in the first position inhibits, and in the second position establishes, a connection between the capillary end section and the transport tube;
a suction device creating a lower pressure in said second container and in said transport tube, such that, when said piston is in said second position, solution is transported from said capillary end section into said transport tube; and

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a transport stage with motors for moving said pipette with said capillary end section to the position of said selected specific particle in said solution in said first container, which transport stage is controlled by said computer with said computer program.

15. (new) Apparatus for automatic isolation of particles, comprising:

- a reservoir containing a solution with particles;
- a first container into which an amount of said solution with said particles is fed from said reservoir;
- a second container for accumulation of specific ones of said particles;
- a capillary tube device for picking out one of said specific particles from said first container and for transporting said specific particles to said second container;
- a computer system;
- a camera system for recording images of said particles and transferring those images digitally to said computer system; and
- a computer program implemented in said computer system, which computer program evaluates said images, identifies and selects said specific particle from said images by predetermined parameters, protocols physical/chemical and/or biochemical characteristics of said specific particle, and controls said picking out and said transport of said specific particle; said capillary tube device comprising:
 - a pipette with a transparent capillary end section for picking out said specific particle from said first container by sucking out of said first container a small portion of solution that contains said particle;
 - a transport tube connected to said pipette for transporting said specific particle from said capillary end section to said second container;
 - a supplier tube connected to said pipette;
 - a piston inside said pipette;

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a moving device to move said piston between a first and a second position, which moving device is controlled by said computer system with said computer program determining said first and said second positions, where said piston in said second position establishes a connection between the capillary end section and the transport tube and inhibits a connection between the supplier tube and the transport tube;

a hollow channel in said piston, which channel, when said piston is in said first position, inhibits the connection between said capillary end section and one of said transport tube and said supplier tube but connects said supplier tube with said transport tube such that fluid can flow from said supplier tube to said transport tube;

a suction device creating a lower pressure in said second container and in said transport tube, such that, when said piston is in said first position, solution is transported from said supplier tube to said transport tube, and when said piston is in said second position, solution is transported from said capillary end section into said transport tube; and

a transport stage with motors for moving said pipette with said capillary end section to the position of said selected specific particle in said solution in said first container, which transport stage is controlled by said computer with said computer program.

16. (new) Apparatus for automatic isolation of particles, comprising:

- a reservoir containing a solution with particles;
- a first container into which an amount of said solution with said particles is fed from said reservoir;
- a second container for accumulation of specific ones of said particles;
- a capillary tube device for picking out one of said specific particles from said first container and for transporting said specific particles to said second container, wherein said capillary tube device comprises a transparent section with an inner cross section larger than said specific particles;
- a computer system;

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a camera system for recording images of said particles and transferring those images digitally to said computer system, where the field of view of the camera contains said transparent section; and

a computer program implemented in said computer system, which computer program evaluates said images, identifies and selects said specific particle from said images by predetermined parameters, protocols physical/chemical and/or biochemical characteristics of said specific particle, and controls said picking out and said transport of said specific particle; said capillary tube device comprising:

a pipette with a transparent capillary end section for picking out said specific particle from said first container by sucking out of said first container a small portion of solution that contains said particle;

a transport tube connected to said pipette for transporting said specific particle from said capillary end section to said second container;

a supplier tube connected to said pipette;

a piston inside said pipette, wherein the volume of the pipette chamber is changed by the movement of said piston;

a moving device to move said piston between a first and a second position, which moving device is controlled by said computer system with said computer program determining said first and said second position, where said piston in said second position establishes a connection between the capillary end section and the transport tube and inhibits the connection between the supplier tube and the transport tube;

a hollow channel in said piston, which channel, when said piston is in said first position, inhibits the connection between said capillary end section and one of said transport tube and said supplier tube and connects said supplier tube with said transport tube such that fluid can flow from said supplier tube to said transport tube;

a suction device creating a lower pressure in said second container and in said transport tube, such that, when said piston is in said first position, solution is transported from said supplier tube

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to said transport tube, and when said piston is in said second position, solution is transported from said capillary end section into said transport tube; and

a transport stage with motors for moving said pipette with said capillary end section to the position of said selected specific particle in said solution in said first container, which transport stage is controlled by said computer with said computer program.

17. (new) Apparatus for automatic isolation of particles, comprising:

a reservoir containing a solution with particles;

a first container into which an amount of said solution with said particles is fed from said reservoir;

a second container for accumulation of specific ones of said particles;

a capillary tube device for picking out one of said specific particles from said first container and for transporting said specific particles to said second container;

a computer system;

a camera system for recording images of said particles and transferring those images digitally to said computer system; and

a computer program implemented in said computer system, which computer program evaluates said images, identifies and selects said specific particle from said images by predetermined parameters, protocols physical/chemical and/or biochemical characteristics of said specific particle, and controls said picking out and said transport of said specific particle; said capillary tube device comprising:

a pipette with a transparent capillary end section for picking out said specific particle from said first container by sucking out of said first container a small portion of solution that contains said particle;

a transport tube connected to said pipette for transporting said specific particle from said capillary end section to said second container;

a supplier tube connected to said pipette;

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a turnable cylindrical core inside said pipette;
a turning device to turn said turnable cylindrical core between a first and a second position, which turning device is controlled by said computer system with said computer program determining said first and said second position;
a hollow channel in said turnable cylindrical core, which channel, when said turnable cylindrical core is in said first position, connects said supplier tube with said transport tube and closes a connection to said capillary end section, and which channel, when said turnable cylindrical core is in said second position, connects said capillary end section with said transport tube and closes said supplier tube;
a suction device creating a lower pressure in said second container and in said transport tube, so that, when said turnable cylindrical core is in said first position, solution is transported from said supplier tube to said transport tube, and when said turnable cylindrical core is in said second position, solution is transported from said capillary end section into said transport tube; and
a transport stage with motors for moving said pipette with said capillary end section to the position of said selected specific particle in said solution in said first container, which transport stage is controlled by said computer with said computer program.

18. (new) Apparatus according to any one of the claims 11-17, wherein said reservoir defines an internal volume, said apparatus further comprising:

a cylindrical mantle surrounding the suspension, which cylindrical mantle has an upper wall, a lower wall and a curved wall;

first and second liquid permeable membranes that divide the internal volume of the reservoir into first, second, and third volumes that are mutually distinct, said first volume being between said first membrane and said upper wall of the mantle, said second volume being between said first and second membranes, and said third volume being between said second membrane and said lower wall of the mantle;

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an axle at least partly inside the reservoir, which axle is situated along the center of said cylindrical mantle, along which axle, said first membrane is movable;
a moving device for controlled movement of the first membrane along the axle;
a pump with a tubing, which pump pumps suspension from said first volume through said tubing into said third volume; and
a feeding tube to feed suspension from said reservoir to said first container.

19. (new) A method of using the apparatus according to any one of the claims 11-17 for the isolation of a material selected from the group consisting of specific cell types, cell clusters obtained by treating organic tissue with dissociating methods, and Islets of Langerhans.